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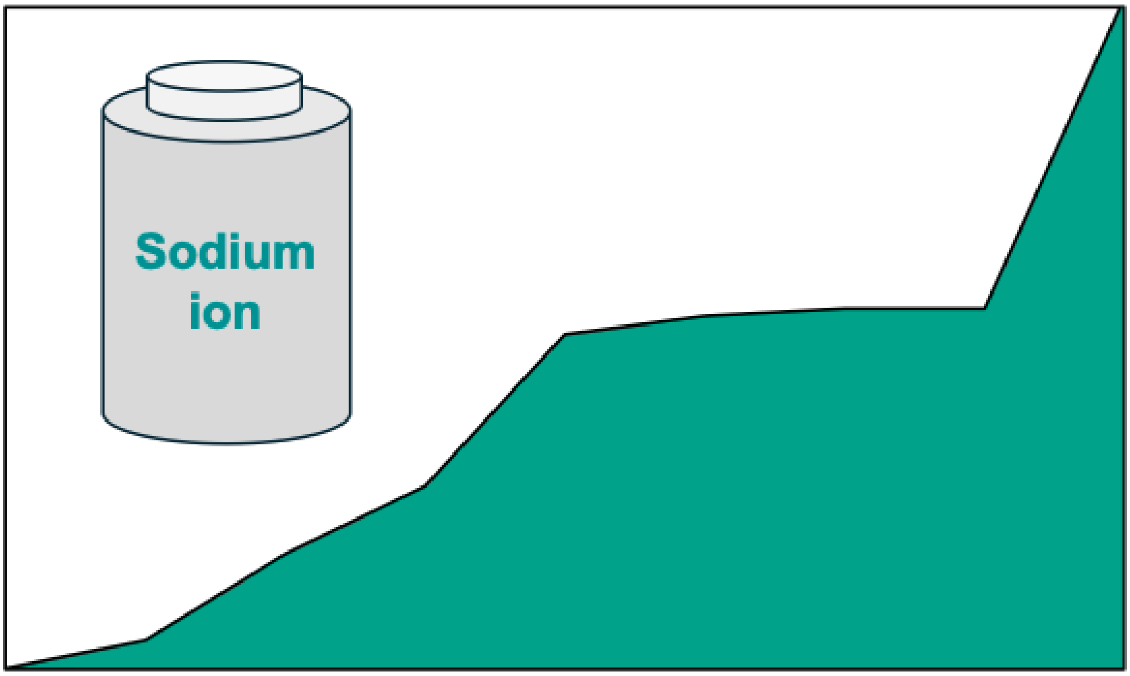

Status and prospects of the sodium-ion battery production system until 2030

The 2025 update

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Summary

This study investigates the evolving sodium-ion battery (SIB) production system through the activities of SIB producing companies. It seeks to answer how much SIB is produced currently, in 2025, and how much will be produced in 2030. It also seeks to answer who the main producers of SIB are and will be, which types of SIBs are produced now and will be in 2030, what the gravimetric energy density (Wh/kg) of the produced SIBs are, and in which applications the SIBs will be used. An analysis of online material from 45 SIB producers revealed that the production in 2025 was approximately 70 GWh, and that this is expected to increase to about 250 GWh in 2030. Depending on the future growth of lithium-ion batteries, this corresponds to about 5-10% of the rechargeable battery market in 2030. 13 of the companies are estimated to account for about 90% of the world's SIB production in 2030, and particularly CATL and BYD are estimated to dominate production with approximately 50% together. In general, Chinese companies are estimated to dominate the production with about 66% of the current SIB producers and 84% in terms of production volume in 2030. Three types of SIB cathode materials (layered metal oxides, polyanionic compounds, and Prussian blue analogs) are all considered by major producers and likely to be produced in 2030. Regarding anode materials, the majority of companies (about 95%) use hard carbon. The gravimetric energy densities reported are in the range of 95-175 Wh/kg, with a mean value of 144 and a median value of 150 Wh/kg. Both electric vehicles and stationary battery energy storage systems are highlighted as potential applications, particularly smaller electric vehicles like electric scooters.

Sammanfattning

Denna studie undersöker det framväxande produktionssystemet för natriumjonbatterier genom att studera aktiviteten hos natriumjonbatteriproducenter. Den ämnar svara på hur mycket natriumjonbatteries som produceras nu, år 2025, och hur mycket som kommer produceras 2030. Den ämnar även svara på vilka de huvudsakliga natriumjonbatteriproducenterna är och kommer vara, vilka typer av natriumjonbatterier som produceras och kommer produceras, hur hög den gravimetriska energidensiteten (i Wh/kg) är för de producerade batterierna, och i vilka applikationer natriumjonbatterierna kommer användas. En analys av material på nätet från 45 natriumjonbatteriproducenter visade att produktionen 2025 var ungefär 70 GWh, vilket förväntas öka till ungefär 250 GWh år 2030. Beroende på den framtida tillväxten av litiumjonbatterier kommer detta motsvara ungefär 5-10% av marknaden för laddbara batterier 2030. 13 av företagen förväntas stå för ungefär 90% av världens natriumjonbatteriproduktion 2030, och i synnerhet CATL och BYD väntas dominera produktionen med ungefär 50% tillsammans. Generellt bedöms kinesiska bolag dominera produktionen med ungefär 66% av alla nuvarande natriumjonbatteriproducenter och 84% av produktionen 2030. Tre typer av katodmaterial för natriumjonbatterier (metalloxidlager, polyanjoniska ämnen och preussiskt blått-analoger) används av de större producenterna och kommer sannolikt produceras 2030. Gällande anodmaterial använder en majoritet (ungefär 95%) av företagen hårt kol. Den gravimetriska energidensiteten rapporteras i spannet 95-175 Wh/kg, med ett medelvärde på 144 och ett medianvärde på 150 Wh/kg. Både elfordon och stationär energilagring lyfts fram som potentiella applikationer, i synnerhet mindre elfordon såsom skotrar.

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1. Introduction

Rechargeable batteries have become a key enabling technology in society and for the ongoing sustainability transition. They can serve as power sources in electric vehicles that can replace internal combustion engine vehicles, and they can store intermittent energy from wind and solar power. The currently dominating technology for rechargeable batteries is the lithium-ion battery (LIB), in which lithium ions carry the electric charge through the electrolyte. There are several types of LIBs, of which the currently most prominent are the nickel-manganese-cobalt (NMC) and lithium-iron-phosphate (LFP) types, detailed further in Table 1. The NMC type furthermore comes with different proportions of the elements nickel (N), manganese (M) and cobalt (C) in the cathode, such as 1:1:1, 6:2:2 and 8:1:1. The importance of the LIB for the sustainability transition is hard to understate, as evident also from the Nobel Prize in chemistry in 2019. Life cycle assessment (LCA) studies have shown that electric vehicles powered by LIBs already have lower climate impacts than internal combustion engine vehicles almost everywhere in the world, despite variations in carbon intensity of local electricity mixes (Knobloch et al., 2020). Additionally, impacts can become even lower given electricity mixes with low impacts, like those dominated by wind and solar power.

Despite its importance, LIB technology comes with some challenges. First, there is always a race towards higher technical performance in technology development, such as higher energy density in the case of batteries. Here, other battery types, such as lithium-sulfur and lithium-air batteries, could have higher energy density and other performance measures once fully developed (Stephan et al., 2023). Second, while LIBs are important enablers of the sustainability transition, it is possible to reduce the impacts of the batteries themselves. The impacts of producing LIBs have been shown in LCA studies to decrease notably when produced in large-scale gigafactories (Chordia et al., 2021). However, the impacts of upstream battery material production and raw material extraction remain also at large scale. Especially the NMC battery contains several rare metals with low concentrations in the crust, particularly lithium, nickel and cobalt (17, 59 and 27 ppm, respectively) (Rudnick & Gao, 2014). This results in high impacts during extraction and beneficiation, but also in long- and short-term resource concerns. In the long term, declining ore grades may limit the supply of these metals for future generations at reasonable energy costs (Gordon et al., 2007). In the short term, the rarity of these metals mean they are only available in certain places at extractable grades, making them potentially critical to certain regions like the European Union (European Commission, 2023).

In the context of resource concerns of LIBs, sodium-ion batteries (SIBs) have emerged as a potential complement or even substitute. Of all next-generation battery technologies (meaning the generation beyond LIBs), SIBs seem to be the one closest to commercialization. The technology readiness level of SIBs has been estimated at 8-9 (Stephan et al., 2023), meaning close to or at commercialization. In SIBs, sodium ions rather than lithium ions carry the electric charge through the electrolyte.

Like LIBs, SIBs also come in different types. Most have hard carbon negative electrodes, but the positive electrode materials vary. Common types include layered metal oxides, polyanionic compounds, and Prussian blue analogs. Table 1 provides a comparison between LIBs and SIBs regarding some important performance parameters and composition. However, this reflects a general understanding of SIB technology. A more detailed description of the current status of SIBs regarding composition and performance is provided in Section 3 based on this study, showing different compositions and performances for different SIB producers.

Table 1. Characteristics of some LIBs (NMC and LFP) (Volta Foundation, 2025) and SIBs (Stephan et al., 2023) at the cell level. Note that the values represent approximately current typical estimates. There are variations within the technologies, such as between SIB producing companies (see further Table 2).

Battery type	Full name	Positive electrode	Negative electrode	Gravimetric energy density (Wh/kg)	Volumetric energy density (Wh/L)
NMC (622 and 811)	Nickel-manganese-cobalt oxide	Nickel manganese cobalt	Graphite	200-250	350-600
LFP	Lithium-iron-phosphate	Lithium iron phosphate	Graphite	170	300
SIBs	Sodium-ion batteries	Layered metal oxides / polyanionic compounds / Prussian blue analogues	Hard carbon	140-160	200-300

1.1 Aim

In this study, we are interested in the future development of SIB production. The aim is to answer the following questions:

What is the current production of SIBs, and how much will be produced in 2030?
Answering this question will reveal whether there is a significant production in 2025, and how large production can be expected in 2030. These production estimates can then be compared to those of LIBs to understand the potential role of SIBs in the near-future rechargeable battery market.

Who are the main producers of SIBs, and where are they located geographically?
Which companies produce SIBs and where they are located have geopolitical implications. There are currently concerns over China's dominance over battery production in several other regions. The use of fewer rare materials in SIBs brings the potential for producing them in multiple regions, but the question is whether that will actually happen or if China will continue to dominate production also for SIBs.

Which types of SIBs are produced now and in 2030?
As noted in Table 1, there are some SIB types that are frequently mentioned in the scientific literature and other sources. We are interested in which of these types are considered by SIB producers and thus likely to also become commercialized. For example, it might be that a dominant design among these will emerge, rather than an equal 33% split of the market. Also, other cathode and anode materials that are less prominent in the scientific literature might show up.

What is the gravimetric energy density of the produced SIBs?
While we acknowledge that the gravimetric energy density is far from the only relevant battery performance parameter, it is still a parameter of fundamental interest for batteries. The amount of energy that a battery cell can contain influences in which applications the battery will be used, particularly for applications like vehicles where the amount of mass (and volume) that can be carried

is limited. Also, it is the most frequently reported performance parameter, making cross-company comparisons possible.

In which applications will the produced SIBs be used?
It has sometimes been presumed that SIBs have too low gravimetric energy density to be used in (especially larger) electric vehicles but are restricted to stationary storage in so-called battery energy storage systems (BESS) and other applications with more limited demands. It is of interest to see if this is also what the companies producing SIBs believe, or if they highlight electric vehicles as a potential application. It is also of interest to see if they highlight any unexpected applications not often mentioned in the literature.

1.2 Previous research

There are many consultant reports that describe the current and future market of SIBs, which can be bought for a fee. Such reports often provide estimates of the future value of the SIB market and the compound annual growth rate (CAGR), which is a measure of the growth of the market. They also list companies active in SIBs and provide information about their technologies. Examples of companies providing such reports are Shanghai Metals Market, Benchmark Minerals, IDTechEx, Market Research Futures, Verified Market Research, BBC Research, and Custom Market Insights. Among the results publicly showcased as advertisement for such reports are often the total market value in the near future (around 2030), often in the (wide) range of some hundred Million USD to several thousand Million USD. The CAGR is typically reported in the range of 10-20% between approximately 2025 and 2030. In a summary of one consultant report, the company IDTechEx (n.d.) writes that current SIB production is limited to a few GWh per year at pilot-scale facilities (specifically 4 GWh in 2024), but expansion plans from battery manufacturers indicate it will likely exceed 100 GWh by 2030 (although they state 90 GWh in 2035 in another place in the summary). They also point out that SIBs can be complementary and not necessarily a replacement to LIBs, with likely applications in BESS and smaller electric vehicles.

These reports typically come with some limitations. The method and data behind the estimates are seldom transparent. Also, the focus of these reports is often on the monetary value of the market, whereas the focus of this study is rather on physical production, as explained in Section 2. The fees required to read the full reports and any details therein are often >1000 USD (sometimes >5000 USD), which makes it difficult for actors with limited funds (such as governmental agencies, NGOs, smaller companies, researchers, and the public) to acquire such reports.

There are several roadmaps written by researchers and research institutes, which are typically longer reports or publications about SIBs and their development. The *2021 roadmap for sodium-ion batteries* (Tapia-Ruiz et al., 2021) provides an overview of the technical status of SIBs. They outline the three main types of SIBs currently under development: Layered metal oxides, Prussian blue analogues, and polyanionic compounds, and deep dive into the physics of each of these. Especially the British company Faradion's technology is covered in depth. Another relevant roadmap is the *Alternative Battery Technologies Roadmap 2030+* by Stephan et al. (2023), where SIBs are discussed along a number of other next-generation battery technologies (such as zinc-ion, lithium-sulfur, and lithium-air batteries). SIBs are there described as one of the alternative battery technologies closest to commercialization in the near future, with similar properties as LFP batteries. They highlight that lighter vehicles such as two- and three-wheelers and small electric vehicles, as well as BESS, are likely applications for SIBs prior to 2035. They estimate the technical readiness level (TRL) of SIBs to be 8-9, which effectively means full or close to full technological maturity. High temperature resistance and similar production processes to LIBs are highlighted as reasons to expect notable SIB growth in the near future. From an analysis of peer-reviewed papers and patents about SIBs, they find that China is dominating the publication rate (about 65%) whereas the patenting is more evenly distributed between China, the US, the EU, and Japan.

Another important report in the field is the annual *Battery Report* from the Volta Foundation (colloquially referred to as the Volta report), which provides an overview of the most significant developments in the battery industry (Volta Foundation, 2025). This is a massive source of information on existing battery technologies, with a focus on LIBs but covering also emerging battery technologies such as SIBs, zinc-ion batteries, solid-state batteries, and flow batteries. Regarding SIBs, the 2024 report highlights the most prominent actors and materials, as well as reported capabilities and likely applications. However, it has a focus on recent events, specifically from the previous year, and not on predictions of the future.

Many scientific papers discuss SIBs in various ways, mainly from a technical perspective, as can be seen in several review papers (Eftekhari & Kim, 2018; Hwang et al., 2017). These largely eco what is written in the roadmaps above. A particularly important scientific paper in this context was published by Yao et al. (2025). They performed a critical techno-economic assessment of the competitiveness of SIBs against LIBs, focusing specifically on the layered metal oxide $NaNi_{0.33}Mn_x(M)_{0.67-x}O_2$ type of SIB. They estimated prices for battery production based on learning curves for LIBs and SIBs, and included projected prices for the material required (which constitute a “price floor” for the technology even as production becomes more efficient). They found that SIBs will likely not be price competitive against low-cost LIBs in the near future, but could become so in the 2030s given technological improvements in SIBs as projected by roadmaps. Essentially, they point out that reaching lower prices than current LIBs is challenging for SIBs. However, as the authors point out, there are considerable uncertainties in these estimates, not least in the fluctuating mineral prices of the materials lithium, graphite and nickel used in LIBs.

To conclude, all these sources point towards a great interest in SIBs and a likely increase in future SIB production. There is an agreement on the dominance of China, likely future applications (BESS and small electric vehicles), and main SIB technologies (layered metal oxides, Prussian blue analogues, and polyanionic compounds). However, openly available estimates of current and future SIB production are rare.

2. Method

From a theoretical point of view, this work can be referred to as concerning the *morphology* of the future SIB production system, meaning its development along certain dimensions (Andersson et al., 2021). In line with the aim of this study, the aspects and dimensions of the SIB production system considered here are:

- The size of the current and future SIB production system (What is the current production of SIBs, and how much will be produced in 2030?)
- The actors involved in the current and future SIB production system, as well as the spatial dimension (Who are the main producers of SIBs, and where are they located geographically?)
- The technological dimension (Which types of SIBs are produced now and in 2030? What is the gravimetric energy density of the produced SIBs? In which applications will the produced SIBs be used?)

Together, these dimensions can be seen as “shaping” the SIB production system, thereby defining its current and future size and form.

2.1 Company selection

This study focuses on companies that produce SIBs now or aim at doing so in the future. There are currently only a limited number of companies producing SIBs (Tapia-Ruiz et al., 2021), so studying their operations can give an idea of which and how much SIBs can be expected in the future. SIB production companies included in the study are obtained from a number of sources, in particular Tapia-Ruiz et al. (2021), Ruiz et al. (2023), FutureBatteryLab (2024), ECO teardown (2024), Li et al. (2025), and the Volta Foundation (2025). Many companies are mentioned by several of these sources, so there is a high degree of agreement about which the most prominent current and future SIB producers are. Table 2 provides an alphabetical list of these companies.

To avoid double counting, only companies producing SIBs were considered, and not those producing battery components or materials. Otherwise, summing 10 GWh of cathode material production with 10 GWh of SIB cell production could give the impression of 20 GWh SIBs in total, while the true total would be 10 GWh since the cathode materials are used in the cells. This means, for example, that the Swedish company Altris was not considered, since they mainly aim at producing cathode materials. Instead, the SIB-producing company to which the cathode material will likely be delivered, which currently seems to be Clarios (Clarios, 2024), was considered. Also, companies that have gone bankrupt were not considered.

2.2 Data gathering

Each identified company was carefully investigated through the online material available, using Google searches with the company name together with the terms “sodium ion battery”, “gigafactory”, “GWh”, “Wh/kg”, and similar, and snowballing from there. In line with the aim of the study, the information gathered (if available) contains:

- Current and future production capacity for specific years (in GWh/year)
- Geographical region, for example country
- Cathode and anode materials used
- Gravimetric energy density at cell level (in Wh/kg)
- Existing and envisioned applications

The country in which the company operates is in most cases feasible to identify. Cathode and anode materials are often reported, but not always. In some cases, broader terms are used, such as “solid-state battery”, indicating the type of battery but not exact cathode and anode materials. The gravimetric energy density is also sometimes reported, almost always in Wh/kg at cell level. Current and future production capacity are reported less frequently, and mainly for the more major producers. Existing and envisioned applications are sometimes stated and can in some cases be inferred from certain formulations.

This study estimates production volumes in physical units, rather than monetary. This reflects an industrial ecology perspective, where the focus is often on material and energy flows due to their link to environmental and resource problems (Ayres & Ayres, 2002). Specifically, production volumes in the unit GWh/year are gathered, which is a common unit for quantifying battery production size (although the “per year” is often implicit, also in this study). In other works on battery production, the focus is rather on economic value (like in the consultant reports discussed in Section 1.2).

It should be noted that news about openings of new, large battery factories (gigafactories) and technological breakthroughs in the SIB field are rarely announced in the scientific literature. Rather, this is reported in company press releases, social media, and on certain webpages focusing on SIBs, batteries, and/or electromobility. Therefore, this study includes many sources normally not considered in scientific reports, such as webpages and social media posts. An important point to make is that this approach can lead to both over- and underestimations of production capacity. Overestimations can occur since not all announced plans become reality. Some announcements about, for example, gigafactory openings might lead to actual openings, and some might not. Underestimations can occur since not all plans are announced, at least not publicly on the Internet.

3. Results and discussion

This section begins with a detailed record of all SIB producers considered. Then, future production capacity estimations based on the gathered production data are presented and discussed, as well as compared to other forecasts of SIBs, LIBs and rechargeable batteries in general. The next sections present the spatial and technological dimensions, respectively. That is, where are SIBs produced (now and in 2030), which kinds of SIB technologies are and will be produced, what are their gravimetric energy densities, and in which applications will they be used. Finally, potential events that could disrupt the production estimates are discussed, in particular related to the relationship between SIBs and LIBs. A summary of the data gathered that underpins the analysis is provided in Table 2.

Table 2. Overview of companies producing SIBs, their location, technology, estimated production volumes, and anticipated applications. LMO=layered metal oxide, PA=polyanionic compounds, PBA=Prussian blue analogs, HC=hard carbon, SC=soft carbon, EV=electric vehicles (sometimes specified as small or heavy EVs), BESS=battery energy storage system.

Company	Country	Cathode material	Anode material	Gravimetric energy density (Wh/kg)	Capacity (GWh/year)	Application
Acculon Energy	USA	-	-	-	2 (2024)	BESS
Amandarry & Sodium Power	China, USA	LMO	-	150	0.5 (2021) 1-2 (2026-2027)	BESS, small EVs
BMZ	Germany	-	-	-	-	BESS, small EVs
BYD	China	LMO, PA	HC	160 (LMO), 130 (PA)	30 (2026)	BESS, small EVs
CATL	China	PBA	HC	175	10 (2025) 30 (2026) 100 (2030)	Small and heavy EVs
CBAK Energy	China	LMO	HC	-	-	BESS, EVs
Cham	China	PA	HC	150	-	Fast charging
Chery	China	-	-	120-200	5 (2024)	EVs
Clarios	USA	PBA	HC	160	-	EVs
Cospowers	China	-	-	-	1.5 (2024) 2 (2026)	-
DFD New Energy	China	LMO	HC, SC	140	1 (2023)	BESS, small EVs
EVE	China	PA	HC	135	-	BESS
Faradion	UK	LMO	HC	160	1e-6 (2017) 0.001 (2025) 5 (2027)	BESS, EVs
Farasis	China	LMO	HC	140-160	3.8 (2023)	BESS, EVs
Godi	India	-	-	-	-	-
Gotion	China	LMO, PA	-	145	-	BESS, EVs
Great Power	China	LMO, PA	HC	150	-	BESS
GuoNa	China	-	-	-	2 (2024)	-
Higee	China	-	-	120	2 (2024)	BESS

Company	Country	Cathode material	Anode material	Gravimetric energy density (Wh/kg)	Capacity (GWh/year)	Application
Highstar	China	PA	HC	90-135	1 (2024-2027)	BESS, small EVs, consumer electronics
HiNa	China	LMO	SC	165	1 (2022) 5 (2023)	BESS, EVs
Indi	India	-	HC	120-140	-	BESS, small EVs, consumer electronics
Jiana	China	PA	HC	-	2 (2026)	-
LiFun	China	LMO	HC	160	-	BESS, small EVs
Lishen	China	LMO	HC	160	-	Small EVs
KPIT	India	PA	HC	170	3 (2026)	BESS, EVs
MANA	US	-	-	-	-	BESS, EVs
Nadion	USA	-	-	122	-	Small EVs
Neg	Japan	-	-	-	-	-
Ningbo Jinglan	China	LMO	-	-	2 (2025) 5 (2028)	-
Novasis	USA	PBA	HC	130	-	-
Pargonage	China	LMO	-	-	5 (2024) 10 (2025)	BESS, small EVs
Peak Energy	US	PA	-	-	20 (2030)	BESS
Phylion	China	-	-	-	-	Small EVs
PowerCap	Australia	-	-	-	5 (2025)	BESS, small EVs
Qingna Technology	China	LMO	-	145	0.2 (2023) 2 (2025) 10 (2030)	BESS, small EVs
Sodion Energy	Singapore / India	-	-	130-140	-	BESS, small EVs
SUNWODA	China	LMO, PA	-	160	-	EVs
Svolt	China	LMO	-	110 (gen 1) 160 (gen 2)	-	-

Company	Country	Cathode material	Anode material	Gravimetric energy density (Wh/kg)	Capacity (GWh/year)	Application
Tiamat	France	PA	HC	80-110 (gen 1) 140-160 (gen 2)	0.7 (2026) 1.5 (2027) 5 (2030)	BESS, small EVs, consumer electronics
Tianneng	China	LMO, PA	HC	95 (PA) 160 (LMO)	-	-
Transimage	China	LMO	HC	150-160	4.5 (2023) 10 (2030)	BESS, small EVs
Unigrid	US	Sodium-chromium-oxide	Tin	170	0.1 (2025) 1 (2026)	BESS, small EVs
Veken	China	LMO, PA, PBA	HC	150	2 (2025)	BESS, EVs
Zoolnasm	China	PA	HC	122	10 (2024) 20 (2030)	BESS, EVs

3.1 SIB companies

Acculon Energy

Acculon Energy is a US-based producer of SIB packs and modules, targeting BESS applications (Maisch, 2024). A production of 2 GWh was scheduled to start in mid-2024. There is little information about which materials are used in Acculon Energy's SIBs and anticipated applications.

Amandarry & Sodium Power

Amandarry & Sodium Power is a joint China-United States venture. Their current production at 0.5 GWh SIBs in China started in 2021. They furthermore aim at beginning production at 1-2 GWh in the US in 2026-2027 (Amandarry, 2025). Their positive electrode material seems to be layered metal oxides (Sodium Power, 2025), and their SIBs can achieve a gravimetric energy density of 150 Wh/kg. The intended applications are BESS and small electric vehicles (electric bicycles, tricycles, motorcycles, and low-speed four-wheelers).

BMZ

The German company BMZ, through its daughter company TerraE, has launched the NaTe series of SIBs in 2024. Series production should reportedly start "around summer 2025" (TerraE, 2024), but there is no information about the magnitude of production. There is also no information about the types of SIBs they intend to produce. However, home energy storage and small electric vehicles (such as forklifts) are mentioned as potential applications.

BYD

BYD announced the opening of a SIB factory in Xuzhou, China in 2024, which is supposed to deliver 30 GWh (Volta Foundation, 2025). Its construction started in 2024, but when it will be ready has not been revealed. Based on previous construction durations for BYD's LIB gigafactories, a duration of 2 years is assumed, meaning that the 30 GWh SIB factory will be ready in 2026. BYD appears to be interested in both layered metal oxides and polyanionic compounds. BYD's layered metal oxide SIBs achieved a gravimetric energy density of 160 Wh/kg in 2024, and their polyanionic SIBs (specifically sodium iron phosphate pyrophosphate, NFPP) were aimed at achieving 130 Wh/kg in 2024 (TYCORUN, 2023a) and higher in 2025 (H2W energy, 2025). BESS and smaller electric vehicles are the main applications mentioned.

CATL

CATL's first generation SIB had a gravimetric energy density of 160 Wh/kg and was used in small electric vehicles (Li et al., 2025). In 2024, CATL announced its second generation SIBs (Volta Foundation, 2025), which is called Naxtra and reportedly achieve a gravimetric energy density of 175 Wh/kg (Laung, 2025; Li et al., 2025). This is claimed to be the highest in the world when it comes to SIBs (CATL, 2025). CATL uses Prussian blue analogues (specifically Prussian white) and hard carbon in their SIBs. The Naxtra battery is aimed towards electric vehicles – both passenger vehicles (where it offers a range of 500 km) and heavy-duty trucks, where it is used together with LFP batteries in a so-called dual-power or cross-chemistry battery (CATL, 2025). Estimations of Naxtra production rates point at 10 GWh in 2025, 30 GWh in 2026 and potentially 100 GWh in 2030 (Wang, 2025).

CBAK Energy

CBAK Energy has a clear ambition to manufacture SIBs (CBAK Energy, 2024), but the extent of this manufacturing, or which SIB technology they are working with, does not seem to be publicly disclosed. Production of both LIBs and SIBs for BESS and electric vehicle applications is mentioned in their annual report, but the share of SIBs is not disclosed (CBAK Energy, 2025). However, an experimental dissection of CBAK's commercial batteries reported a hard carbon anode and layered metal oxide cathode (Dorau et al., 2024).

Cham

Cham offers a 32140 SIB battery for low-temperature applications, including fast charging (ACCESS newswire, 2024). ECO teardown (2024) reported that Cham produced SIBs with polyanionic compounds and hard carbon, achieving a gravimetric energy density of 150 Wh/kg. However, no information about production volumes has been found.

Chery

In collaboration with CATL, Chery has set up a battery manufacturing plan with a capacity of 5 GWh in China in 2024 (Chery, 2024). This seems to be a different plant from CATL's other operations, and is thus counted separately here. There are ambitions to scale up production in the coming years, but no information about to which capacity. The SIB they aim at producing is reportedly a solid-state SIB. Apparently, batteries in a wide range of gravimetric energy densities (120-200 Wh/kg) are expected from that plant (Krampf, 2024a). Which materials this battery consist of has not been possible to determine in this study.

Clarios

Clarios is a US battery producer historically focused on lead-acid batteries, but in 2024 they invested in the SIB cathode active material developer Altris (Clarios, 2024). Altris develops Prussian blue analogue SIBs, specifically with Prussian white, and have reported a gravimetric energy density of 160 Wh/kg (Altris, 2023). The main intended application is in electric vehicles, but not for vehicle propulsion, but for low-voltage applications like autonomous functions and cabin experiences. Clarios report that pilot production is expected to begin in 2026 (Clarios, 2024), but no exact production volumes have been reported.

Cospowers

Cospowers announced a 1.5 GWh SIB battery production in 2024. Also, they announce that after the production line is put into operation, the SIB capacity will be upgraded to more than 2 GWh (Cospowers, 2024). For this reason, we assume that Cospowers' capacity will be at least 2 GWh in 2026. No information about the gravimetric energy density, applications, anode and cathode materials have been found.

DFD

DFD produced SIBs with a capacity of 1 GWh in 2023 and plans for expansion (ICCSINO, 2023). They reportedly work with all three types of cathode materials as well as both soft and hard carbon in the anodes, and can reach a gravimetric energy density at 140 Wh/kg (ECO teardown, 2024). Their batteries are mainly intended for energy storage and small EVs, such as two-wheelers and tricycles (TYCORUN, 2023b).

EVE

EVE produces SIBs called NF155L, which have been deployed in a large-scale BESS facility in 2025 (Gasgoo, 2025). The reportedly use layered metal oxides and hard carbon in their SIBs (ECO teardown, 2024), but later sources instead suggest that EVE's NF155L batteries are polyanionic compound SIBs of the type sodium iron phosphate pyrophosphate (NFPP) (BESS, 2025; SMM, 2025a). Thus, polyanionic compounds is in this study assumed to be the main SIB type developed by EVE. A gravimetric energy density of 135 Wh/kg had been achieved for EVE's SIBs in 2023 (Randall, 2023), which is assumed in this study. No information about the magnitude of the SIB production has been found.

Faradion

The UK-based company Faradion, owned by the Indian company Reliance, develops SIBs with Na-Ni-Mn-Mg-Ti (NMMT) layered metal oxide positive electrodes and hard carbon negative electrodes (Rudola et al., 2021; Tapia-Ruiz et al., 2021). In their early days, Faradion considered polyanionic compounds, but they later moved to layered metal oxides (Li et al., 2025). Their SIB cells have a gravimetric energy density of up to 160 Wh/kg and aiming for 190 Wh/kg in their next generation (Faradion, n.d.). Both BESS and electronic vehicles are mentioned as potential applications on Faradion's webpage. Already in 2017, they had produced 5 kWh SIB cells (Barker, 2017). Since then, a range of production volume estimates have been suggested for Faradion, complicated by its recent acquisition by Reliance and their reported ambitions. One such report says "megawatt level" production of SIBs in 2025 (Writer, 2024). Much higher claims regarding Reliance's SIB production, in the range 5-30 GWh, have been made by the consultant company IDTechEx (Siddiqi, 2025). However, these claims might be misinterpretations of gigafactory construction plans that include LIB production (Writer, 2024). In this study, a conservative estimation of only 1 MWh in 2025 and onwards has been assumed for Faradion, acknowledging that this might become much more in the future.

Farasis

Farasis launched a SIB-powered electric vehicle in 2024 (Volta Foundation, 2025), but potential applications include also BESS. Their SIBs have confirmed gravimetric energy densities of 140-160 Wh/kg, and they had plans to achieve 160-180 Wh/kg in 2024 and 180-200 Wh/kg in 2026 (Farasis, 2024). Farasis mainly combines layered metal oxides with hard carbon, but might work with other cathode materials as well (Mobility Portal, 2024). In the first six months of 2023, Farasis produced 1.9 GWh (Giordano, 2024), which corresponds to $2\times1.9=3.8$ GWh in 2023 if continuous production is assumed. No more recent production estimates have been found.

Godi

Godi is an Indian company that provides a prismatic SIB (Godi, n.d.). Automobiles, consumer electronics, and BESS applications are all mentioned on their webpage, but it is not specified that SIBs will be used in these applications. In 2024, they released plans to set up a gigafactory for LIBs and SIBs in Telangana in central India, aiming at 2.5 GWh in the first phase and 10 GWh in the second (Energyworld, 2024). Unfortunately, the anticipated share of SIBs is not disclosed.

Gotion

Gotion has developed a hybrid SIB containing both layered metal oxides and polyanionic compounds, with a gravimetric energy density of 145 Wh/kg and potential applications in both BESS and electric vehicles (Wan, 2025). However, no information about production rates or electrode materials has been found.

Great Power

Great Power produces SIBs and has implemented them in a battery energy storage station in northern China (Great Power, 2023b). Like Gotion, Great Power combines layered metal oxides and polyanionic compounds, and can achieve a gravimetric energy density of 150 Wh/kg (Great Power, 2023c). ECO teardown (2024) reports that they also use hard carbon in the anode. In 2023, Great Power planned a gigafactory for production of both LIBs and SIBs, with a first phase of 12 GWh and a second phase of 36 GWh (Great Power, 2023a). However, the distribution between these two battery types has not been found.

GuoNa

The company GuoNa announced in 2024 that its 2 GWh production of SIBs has been put into operation (SMM, 2024a). Apart from this, not much information has been found about GuoNa's SIBs.

Higee

The company Higee released two SIBs in 2023, both achieving a gravimetric energy density of approximately 120 Wh/kg (Higee, 2023). Higee focuses on BESS applications. According to their webpage, Higee has shipped more than 2 GWh energy storage capacity in 2024, which implies they also produced at least 2 GWh of SIBs in 2024. No information about the electrode materials used in Higee's SIBs has been found.

Highstar

Highstar produces SIBs based on polyanionic compounds intended for solar energy storage (Highstar, n.d.). Potential applications also include two-wheelers and consumer electronics, and gravimetric enery densities range between 90 and 130 Wh/kg (Highstar, 2025), and even values up to 135 Wh/kg have been reported (SMM, 2023). Specifically, they develop a sodium iron pyrophosphate (NFP) type of polyanionic compound-based SIBs (Service, 2018). The anode reportedly consist of hard carbon (ECO teardown, 2024). Highstar will produce at least 1 GWh SIBs in 2025 and four years forward (EnergyTrend, 2025). They have a factory of 1.3 GWh that can produce SIBs, but also LIBs (EnergyTrend, 2022).

HiNa

HiNa produces SIBs, some of which are intended for electric vehicles with a gravimetric energy density of at least 165 Wh/kg (Krampf, 2025a). However, BESS facilities in the MWh scale have also been produced with HiNa's batteries, both with SIBs only and in hybrid settings with both SIBs and LIBs (Murray, 2025; Zhang, 2024). Their batteries are of the layered metal oxide type, with soft carbon in the anode (HiNa, n.d.). In 2022, HiNa already had 1 GWh production capacity, with an aim of scaling that up to 5 GWh (McDee, 2022), which has been specified as "next year" in 2022, that is, 2023 (Kang, 2022).

Indi

Indi's SIBs are different in the sense that their hard carbon (called BioBlack) is derived from bio-waste or agricultural waste (Indi Energy, n.d.). They also have a wide range of applications, including smaller electric vehicles, BESS, and consumer electronics. Gravimetric energy densities are in the range of 120-140 Wh/kg. In 2023, no company in India had begun commercial manufacturing of SIBs (Wangchuk, 2023), and Indi was recently considered a start-up company. So, current production volumes are likely negligeble. No specific information about current or future production volumes has been found, nor about the cathode material used.

Jiana

Jiana produces polyanionic compound-based SIBs with hard carbon anodes (SMM, 2024c). Although they are mainly focused on the electrode material production, in 2024, they announced the installation of a 2 GWh SIB cell manufacturing centre (SMM, 2024c). The first phase of that project was to be completed at the end of that year, and although the exact starting year of the 2 GWh production was not stated, it is here assumed at no later than 2026. No further information about Jiana's SIBs has been found.

LiFun

LiFun produces SIBs called J7N0700-S01, with a production capacity of 2.5 GWh for LIBs and SIBs combined (LiFun, 2025). Mass production of SIBs reportedly started in 2023, with a gravimetric energy density of 160 Wh/kg for their second-generation SIB to be produced in 2023, targeting low-cost electric cars, buses and energy storage systems (PushEVs, 2022). ECO teardown (2024) report that LiFun uses layered metal oxide cathodes and hard carbon anodes. No information about specific SIB production volumes has been found.

Lishen

Lishen released a SIB (called LR46120) with hard carbon and a layered metal oxide ($NaNi_{1/3}Fe_{1/3}Mn_{1/3}O_2$ – NMF) in 2023, and a gravimetric energy density of 145 Wh/kg (Lishen, 2023). It was expected to be applied in two-wheelers, loaders, and other small electric vehicles. In 2024, they released a cylindrical SIB with a gravimetric energy density of 160 Wh/kg (SMM, 2024d). No information about the magnitude of Lishen's SIB production has been found.

KPIT

The Indian company KPIT wants to commercialize Trentar's SIB, which has a gravimetric energy density of up to 170 Wh/kg (Gupta, 2025). Together, they aim to construct a 3 GWh SIB manufacturing facility. The exact starting year is not announced, so we here assume 2026. The batteries have a carbon (likely hard carbon) anode and a polyanionic compound cathode (Maisch, 2023). The potential applications are described as "diverse", including both BESS and vehicle applications (Sodium Battery Hub, 2023).

MANA

MANA is a United States company that develops anode-free SIBs (MANA, n.d.). Potential markets are BESS for the grid and electric vehicles (NREL, n.d.). No production volumes have been found. However, the company's operations have been described as "bench scale" (NREL, n.d.) and their cells as "prototype[s]" in 2024 (Mana Battery Inc., 2025), and the company as a "startup" in 2025 (Krampf, 2025b). Since it was founded as late as 2023, the operations are likely still at a modest production volumes. No information about the electrode materials used has been found.

Nadion

The United States company Nadion, in collaboration with the company PHD Energy, provides both cylindrical and prismatic SIB cells (Nadion Energy, n.d.). Some of the batteries are tailored towards low-speed electric vehicles, such as golf carts. They use hard carbon as anode material (Xie, n.d.) and reportedly have a gravimetric energy density of 122 Wh/kg (FutureBatteryLab, 2024). No information about cathode material or production volume has been found.

Neg

Neg – short for Nippon Electric Glass – is a Japanese company that claims to produce an all-solid-state SIB (Neg, n.d.). Beyond this, not much information about Neg's SIB has been found.

Ningbo Jinglan

Ningbo Jinglan has signed an agreement for a 5 GWh SIB production facility (Mysteel, 2025). The first phase involves 2 GWh and is expected to be completed in December 2025. The second phase involves an additional 3 GWh and is expected to be completed in 2028. The anode material will be layered metal oxides.

Novasis

Novasis is a United States company that produces SIBs based on Prussian blue analogs with a gravimetric energy density of 130 Wh/kg (FutureBatteryLab, 2024). They also use hard carbon anodes (Bauer et al., 2018). No more information about this company has been found.

Paragonage
Paragonage is a SIB producer with a 10 GWh production capacity (Paragonage, n.d.). Their production facility opened in 2024, then with a capacity of 5 GWh (Leo G, 2024). The SIBs produced are called X-Star and X-Dragon. Applications listed on their webpage are electric two-wheelers, three-wheelers, and BESS. Their SIBs reportedly utilize layered metal oxides (ECO teardown, 2024).

Peak Energy
Peak Energy is a United States company that produces SIBs with a polyanionic sodium iron pyrophosphate (NFPP) cathode (Peak Energy, n.n.). BESS is the main application targeted. Production of SIBs is expected to being in 2026 (Clark, 2025), or possibly 2027 (Lewis, 2025). In 2030, they aim to deliver >20 GWh annual storage capacity, which means their production rate should at least 20 GWh by then (Peak Energy, n.n.).

Phylion
Phylion released its first SIB – called "Super Sodium F1" – in 2023 (Joseph, 2023), which has now been upgraded to the "Ultra Sodium F1" (Phylion, n.d.). A big focus of this company seems to be two-wheelers. Apart from this, not much information is publicly available about Phylion's SIBs.

PowerCap
PowerCap is an Australian company, which provides SIB for BESS and electric vehicles (PowerCap, n.d.). According to one source, their current manufacturing capacity is 1.8 GWh, but they aim to scale up to at least 5 GWh (Williamson, 2025). Other sources report their production capacity already to be 5 GWh (Biogradlija, 2025; Shanshan, 2025), which is used in this study. Not much else information has been found about their SIB technology.

Qingna Technology
Qingna Technology has built a "quasi mass production line" for 0.2 GWh, which seems to have been operational in 2022 (Qingna Technology, n.d.). They also aim to open a 10 GWh SIB factory, which seems to be operational in 2025 (SMM, 2025c). It is also stated that a 2 GWh production line is expected in 2024 (Qingna Technology, n.d.). However, a different source report that the funds to build the 2 GWh SIB factory was obtained in 2025 (SMM, 2025b). In light of this uncertainty, it is here assumed that Qingna Technology's production was 0.2 GWh in 2023, is 2 GWh in 2025, and will be 10 GWh in 2030. They rely on layered metal oxides, their latest SIBs have an energy density of 145 Wh/kg, and they aim for applications in BESS, two-wheelers, tricycles, and forklifts (Qingna Technology, n.d.).

Sodion Energy
Sodion Energy is based in Singapore, and produces SIBs for use in BESS and lighter electric vehicles, such as forklifts, motorcycles, scooters (Sodium Energy, n.d.). However, its product has been referred to as "India's first sodium-ion battery" (Deccan Chronicle, 2024), so the company also has strong ties to India. The gravimetric energy density is 130-140 Wh/kg (EVreporter, 2024). Considering a recent agreement to supply 10 MWh of SIBs (pv magazine, 2025), their production seems to not yet be in the GWh scale. This agrees with the fact that their first battery was launched in 2024. Also, they have paired up with another producer, UNIGRID (see further below), who will provide the SIB cells for this agreement. The International Tin Association (2025) points out that precisely these UNIGRID-based SIBs have, contrary to most SIBs, tin anodes. However, whether this applied also to Sodion Energy's own SIBs is unclear, as is the cathode material used.

SUNWODA

SUNDOWA produced SIBs with a gravimetric energy density of 160 Wh/kg in 2024 (Gasgoo, 2023), although another source reports that 170 Wh/kg has already been achieved in 2025 (Woody WU, 2025). They seem to be developing SIBs along two trajectories: High energy density SIBs based on layered metal oxides (targeting 180 Wh/kg) and long lifetime SIBs based on polyanionic compounds (targeting 130 Wh/kg). They market their SIBs are being designed to meet various demands across battery and plug-in hybrid electric vehicles. However, most online information about SUNWODA rather refers to their LIBs or newly developed solid-state battery.

Svolt
Svolt is a Chinese SIB producer. Reportedly, their first generation SIB had a gravimetric energy density of 110 Wh/kg, and their second generation achieves 160 Wh/kg (ECO teardown, 2024). They are also reported to use layered metal oxides in their cathodes (FutureBatteryLab, 2024). No other information about Svolt's SIBs has been found.

Tiamat
Tiamat is a French SIB producer, with the aim of having GWh production capacity in 2030 (Tiamat, n.d.). Exactly what and how much is to be produced in 2030 varies between different sources. 5 GWh in 2030 is mentioned, but sometimes that is stated only for Tiamat's generation 1, and that generation 2 will have an even higher production rate (e.g., >10 GWh). Several sources report that the first phase of Tiamat's gigafactory will yield about 0.7 GWh in 2026, and that the full gigafactory at about 5 GWh will be ready around 2030 (Beyer, 2025; Business France, n.d.; Iselin, 2025; Randall, 2024; World Materials Forum, 2023). In addition, a capacity of 1.5 GWh is reported for 2027 (Tiamat, 2025). These later values are applied in the forecast, bearing in mind that the production volumes might become much higher if the second generation also takes off. Their generation 1 has a gravimetric energy density of 80-110 Wh/kg, and their generation 2 achieves 140-160 Wh/kg (World Materials Forum, 2023). Tiamat's cells are based on a polyanionic $Na_3V_2(PO_4)_2F_3$ (NVPF) cathode and hard carbon anode (Battery Industry, 2023). BESS, consumer electronics and electric vehicles are mentioned as potential applications (World Materials Forum, 2023).

Tianneng
Tianneng is primarily a lead-acid battery manufacturer, but has released a series of SIBs (Tianneng Global, n.d.). They rely on layered metal oxides (160 Wh/kg) and polyanionic compounds (95 Wh/kg) (YiCai, 2025) for the cathode, and hard carbon for the anode (ECO teardown, 2024). However, their production of SIBs does not seem to be at the GWh scale yet.

Transimage
The Chinese company Transimage had a SIB production capacity of 4.5 GWh already in 2023 (Zhang, 2023), with a reported gravimetric energy density of 150-160 Wh/kg (Gupta, 2023). Transimage furthermore plans to have a production capacity of 10 GWh (Transimage, n.d.). The date of this capacity increase is not yet specified, so it is here conservatively assumed it will be reached at least in 2030. They reportedly use layered metal oxides and hard carbon in their electrodes (ECO teardown, 2024). Transimage has secured orders related to both BESS and low-speed electric vehicles.

Unigrid
Unigrid is a United States SIB producer, with somewhat unconventional electrode materials. They reportedly have sodium-chromium-oxide in the cathode and tin in the anode (De Chant, 2024; International Tin Association, 2025; Maddar et al., 2025). The reported gravimetric energy density of the cells is as high as 170 Wh/kg (Service, 2025). They have a production capacity of 0.1 GWh

(100 MWh) in 2025 and target 1 GWh in 2026 (Rayner, 2025). Like many other producers, they focus on the applications BESS and various electric vehicles (such as two-wheelers, three-wheelers, passenger cars, and off-road vehicles) (Casey, 2025). Interestingly, the previously-mentioned producer Sodion Energy seems to be buying SIBs from Unigrid (International Tin Association, 2025). This introduces a slight risk of double counting of production volumes.

Veken

Veken is a Chinese battery manufacturer, which works with all three types of SIBs – layered metal oxides, polyanionic compounds, and Prussian blue analogues (Veken, n.d.-a; Veken Industry, n.d.-a). Veken targets both BESS and electric vehicles. An energy density of 150 Wh/kg has been reported for Veken (Veken, n.d.-b), although it is unclear if it applies to all SIB types they work with. Veken reportedly has a 2 GWh production capacity for SIBs in 2025 (Lingtech Battery, n.d.; Veken Industry, n.d.-b).

Zoolnasm

According to several sources, Zoolnasm will build a SIB production facility with a total capacity of 10 GWh in a first phase, and expanding to a total capacity of 20 GWh in a second phase (Chico, 2025; Sodium Battery Hub, 2025; Zhang, 2025). However, when these phases will be completed is less clear. Some sources state that the first phase of 10 GWh would be completed in 2024, while there is no disclosed timeline for phase two (Batteries News, 2023; Manthey, 2023). In any case, construction of the first phase seems to have started in 2023 (Kang, 2023). Thus, it is here thus assumed that Zoolnasm's production capacity was 10 GWh in 2024 and will increase to 20 GWh at least in 2030. They reportedly use polyanionic compounds in their cathodes, hard carbon in their anodes, and reach a gravimetric energy density of 122 Wh/kg (ECO teardown, 2024; Krampf, 2024b). Zoolnasm seems to have interests in both automotive and BESS applications.

3.2 Production estimations

Table 2 reports the production estimates for the companies considered. Figure 1 shows those values plotted for the time period 2022-2030. The total estimated production in 2030 is approximately 250 GWh/year. The major producers, those with estimated production rates >5 GWh/year in 2030, are shown separately. There are 12 such companies. In the year 2025, the number of such major producers is notably lower, namely the six companies CATL, Chery, HiNa, Paragonage, PowerCap, and Zoolnasm. As can be seen in Figure 1, the two companies CATL and BYD will likely dominate SIB production in the 2025-2030 period, together accounting for approximately half of the production of SIBs in 2030. The 12 major producers together account for about 90% of the production.

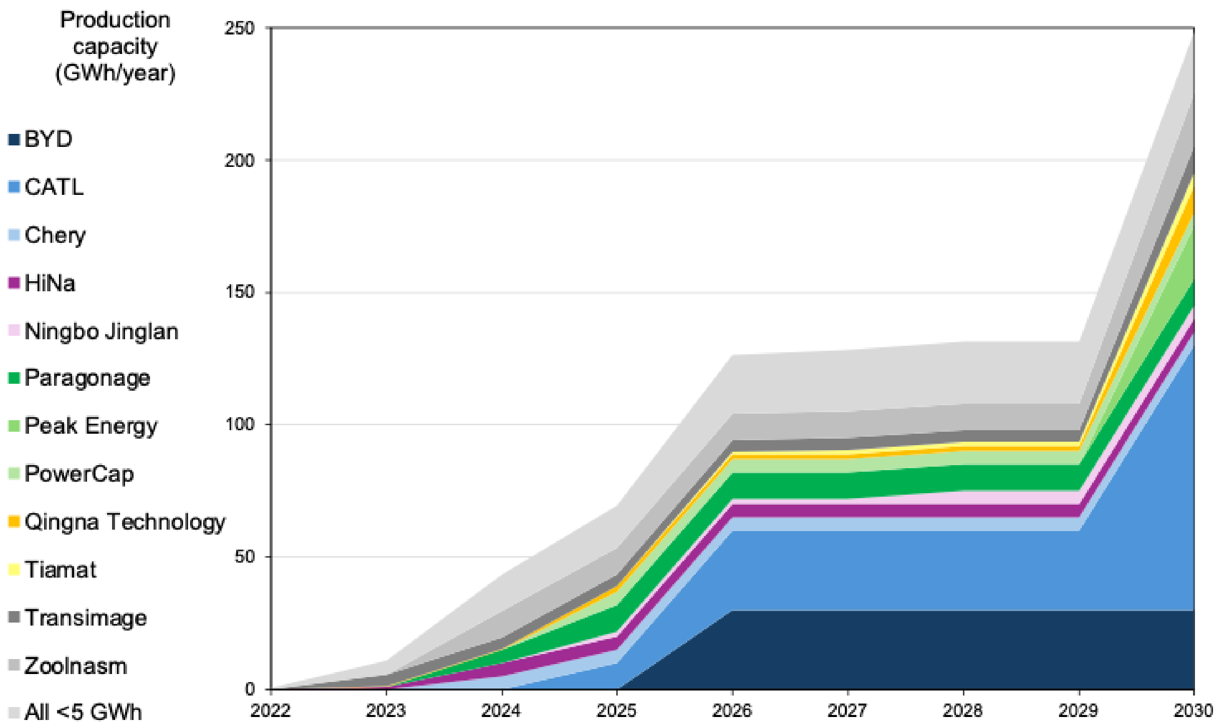

Figure 1. Production estimates from Table 2 plotted from 2022 to 2030. Companies with production capacity >5 GWh/year are shown separately.

Naturally, the production estimates in Figure 1 are subject to uncertainties. Some companies, both those listed in Table 2 and others, might be planning SIB production not yet disclosed to the public. On the other hand, not all SIB production projects have moved forward as planned. In February 2024, the company Kingshine cancelled its proposed 6 GWh sodium-ion battery facility in the Jiangxi Province in China. Veken Tech has postponed its 2 GWh project, originally set for completion in 2024, then rescheduled to begin operations in 2025. The United States company Natron had plans for giga-scale SIB production, but went bankrupt in 2025. These setbacks underscore the ongoing challenges related to demand uncertainty, financing, and scaling up production. Most surely, not all companies in Table 2 will remain in 2030, and some newcomers will likely join the list. However, considering the dominance of CATL and BYD, major disruptions in these companies are required to change the scale of the results.

Such major disruptions of the SIB production could be referred to as black-swan events, that is, surprising events relative to the present knowledge (Aven, 2013). These could lead to both increased and decreased in SIB production. One possibility that would propel the production and use of SIBs would be breakthroughs in performance. The performance of LIBs has increased notably over time, and as discussed in Section 3.5, the highest gravimetric energy density achieved to date is CATL's Naxtra batteries at 175 Wh/kg. Innovations, such as using tin instead of hard carbon as anode material, might increase the specific energy even further, as indicated by early experimental results (Kim et al., 2025).

For a long time, it was considered uncertain whether the electric vehicle would become the dominant passenger car, and other alternatives, such as biofuels and hydrogen, were discussed (Edwards et al., 2014; Edwards et al., 2007). However, at the time of writing (early 2026), there seems to be little doubt that battery-electric vehicles are the main upcoming mode of transport, at least for personal cars and smaller vehicles but probably also for larger vehicles in the future. The role of batteries in storing intermittent electricity from wind and solar is also on the raise. Events that alter this picture would thus be highly unexpected.

While the prominent role of batteries is likely to continue and grow, the role of SIBs in the broader battery area is less certain, in particular regarding the relationship to LIBs. Some highlight the synergistic relationship between SIBs and LIBs, for example, that SIBs can be a drop-in substitute in LIB applications and production processes (Tapia-Ruiz et al., 2021), while others point to the competition between SIBs and LIBs, in particular for LFP batteries (Yao et al., 2025). Technologies can experience a number of general modes of interaction, as described by Sandén and Hillman (2011):

- Competition, which happens when a common resource or market is in short supply. This is the perspective taken by Yao et al. (2025) when comparing SIBs and LFP batteries.
- Symbiosis, where there are interactions that favour both technologies by, for example, enabling a faster market growth of BESS, or sharing new knowledge on battery pack production.
- Neutralism, where the technologies do not affect each other, for example, by being used on separate specialized market segments (like two-wheelers for SIBs and larger electric vehicles for LIBs).
- Parasitism or predation, where one technology benefits and the other is inhibited, for example when SIBs piggy-back on the production knowledge and markets created by LIBs.
- Commensalism, where one technology is benefitted and the other unaffected. This might happen if SIBs piggy-back on LIBs but are mainly used in niche applications where LIBs are not used so much, such as replacing lead-acid batteries in two-wheelers.
- Amensialism, where one technology is inhibited and the other unaffected.

Which of these modes of interaction will best describe the relationship between SIBs and LIBs remains to be seen. However, it can be noted that the total battery market is expected to grow considerably (Edström et al., 2020). Thus, marked demand is not necessarily in short supply. Rather, novel and less expensive battery technologies might open new market segments to battery technology at large. Some LIBs, such as NMC, have high performance but contain rare metals (nickel, cobalt, lithium), which is contrary to SIBs with their lower performance but also fewer rare metals. It is thus fully possible to imagine that they would co-exist in symbiosis, commensalism, or neutralism, perhaps inhabiting different market segments or being used together in certain applications. An example is CATL's Freevoy battery pack for hybrid vehicles, where SIBs and LIBs are integrated to deliver a 280 km rang on a 10-minute charge (Volta Foundation, 2025). There, the LIB stands for most of the energy storage, while the SIB can deliver the energy fast. So, while the interaction between SIBs and LIBs might influence the production estimates in Figure 1, it is not certain that this interaction will disadvantage SIBs.

3.3 Comparison to other SIB, LIB and total battery projections

Here, the estimated 250 GWh/year from Figure 1 are compared to other estimates of SIB production, LIB production, and total rechargeable battery production.

Regarding SIBs, the market research company IDTechEx (n.d.) estimate the production in 2030 to be "well over 100 GWh", but also write "just under 124 GWh" for 2034. This suggests an estimate of roughly half compared to this study. Indi Energy (2024) also report that SIB production capacity "could exceed 100 GWh" by 2030, referring to industry experts. A somewhat higher estimate is reported by SMM (2024b), namely that “[b]y 2030, global demand for sodium batteries is expected to exceed 160 GWh, with sodium energy storage systems accounting for more than half of the market demand” (sodium batteries is here interpreted as SIBs). Chico (2025) cites several consultancy forecasts for the year 2030, ranging from about 40 GWh (citing Wood Mackenzie), to about 340 GWh (citing Benchmark Minerals Intelligence). He also cites the IDTechEx forecast of 100 GWh. Overall, this suggests that the SIB production estimate for 2030 in this study is in the higher range compared to previous estimates. A report from the Fraunhofer Institute provides estimates of the SIB market demand in 2030 from several sources, some as low as 35 GWh and others as high as 580 GWh (Degen et al., 2023). It also reports a SIB production capacity at approximately 80 GWh in 2030. A report from IRENA (2025) cites production estimates from the consultancy firm Benchmark Mineral Intelligence at 70 GWh in 2050 and approximately 400 GWh in 2030.

In the report by Edström et al. (2020), they estimate the total battery demand by 2030 to be approximately 2600 GWh/year. Given the estimate in this study, this means that the SIB production could account for approximately 10% of the battery demand. The Alternative Battery Technologies report estimate the demand for LIBs to be approximately 2000-6000 GWh/year in 2030 (Stephan et al., 2023), compared to which SIBs would constitute 4-13% according to the estimation in this study. Wolf and Lüken (2024) estimate the global battery market at somewhere between 1000 and 6000 GWh in 2030, with the most likely value at 3000 GWh/year. This range is similar to the range in Stephan et al. (2023), and the most likely estimate is similar to that by Edström et al. (2020).

In conclusion, the SIB production estimate in this study is in the higher range compared to previous estimates, and a comparison with estimates for LIBs and total battery production in 2030 indicates that SIBs might constitute about 5-10% of the rechargeable battery market in 2030.

3.4 Spatial dimension

It is clear from the second column of Table 2 that China is dominating in terms of companies. Figure 2 shows the regional shares both in terms of number of companies and production in 2030. China dominates with about 64% regarding number of companies and 86% in terms of production in 2030. Second place is the United States with 16% and 9%, respectively. Europe and India have lowed shares of similar magnitudes. “Others/shared” contains one Japanese company (Neg), one Australian company (PowerCap), one company shared between the United Kingdom and India (Faradion), and one company shared between Singapore and India (Sodion Energy).

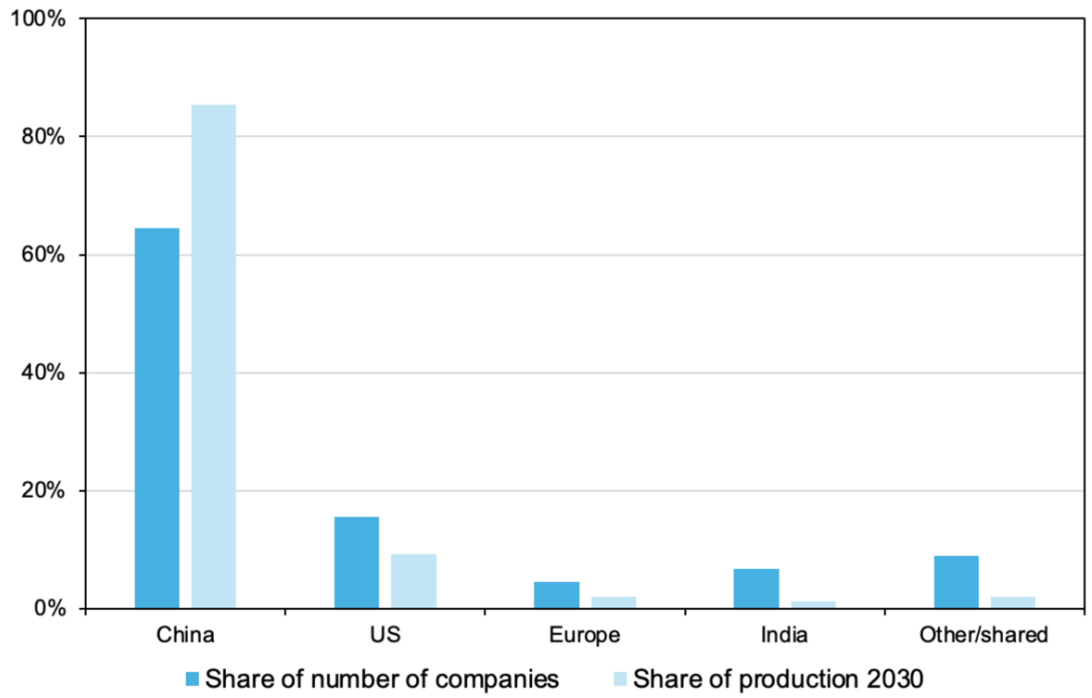

Figure 2. Spatial distribution of SIB companies and production volume in 2030.

3.5 Technological dimension

Here, we provide information about which SIB types are being developed, which gravimetric energy densities they have achieved so far, and in which applications they are envisioned to be used.

Regarding SIB types, this study echoes the scientific literature and other sources that highlight three types of cathode materials: Layered metal oxides, polyanionic compounds, and Prussian blue analogues (Eftekhari & Kim, 2018; Hwang et al., 2017). Figure 3 shows the usage in percentage of number of companies. Most companies work with layered metal oxides (about 65%), followed by polyanionic compounds (about 40%). Prussian blue analogues are less common (about 15%). However, CATL's Naxtra battery contains Prussian blue analogues and has the currently highest gravimetric energy density for a SIB. Considering CATL's expected high production in 2030 (Figure 1), Prussian blue analogues might also become one of the most produced types of battery cell. Thus, all three SIB types should be considered as "in the race" in the sense of being relevant for future large-scale production.

The most common anode material is hard carbon, which is used by about 95% of the companies. This is also much in line with the scientific literature (Eftekhari & Kim, 2018; Hwang et al., 2017). Two other anode materials are explicitly mentioned: soft carbon and tin.

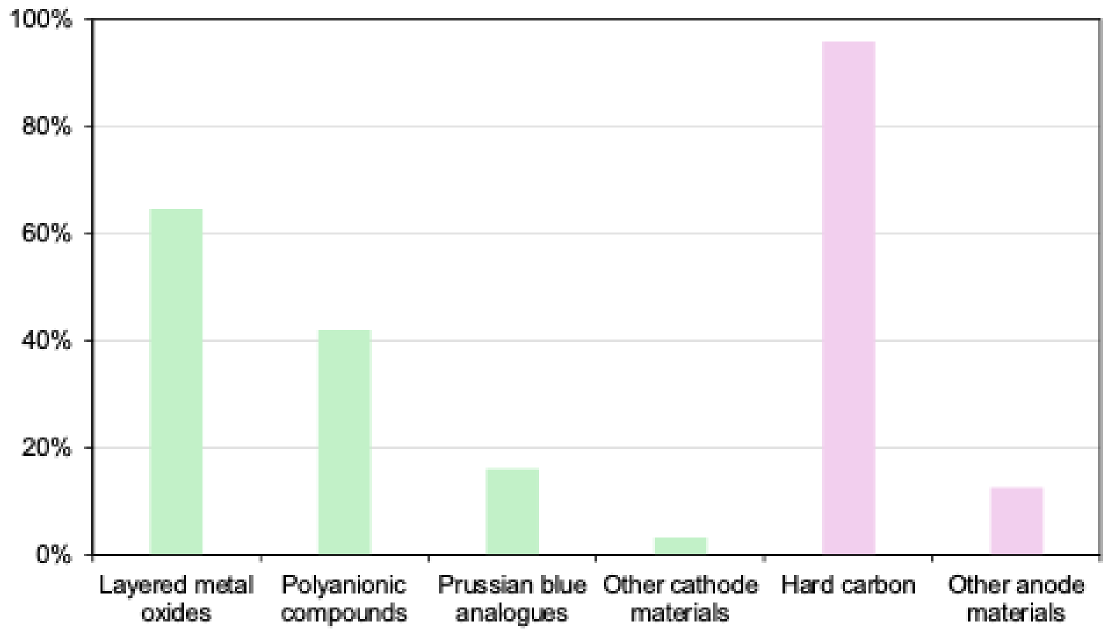

Figure 3. Usage of cathode and anode materials by the SIB producers, in percentage of the number of companies reporting electrode type. Note that some companies work with several cathode and anode materials, which is why the sum of the green cathode and purple anode bars can reach more than 100% each.

Table 3 summarizes the mean, median, maximum and minimum gravimetric energy densities of the reviewed companies' SIBs. Results are shown for all SIBs together, as well as for layered metal oxides, polyanionic compounds, and Prussian blue analogues separately. The mean and median values are calculated based the number of companies that report gravimetric energy density data, not the total set of companies. As can be seen, the mean and median values for the total battery set, for layered metal oxides, and for Prussian blue analogs are all close to 150 Wh/kg. The exception is polyanionic compounds, which are closer to 130 Wh/kg for both the mean and median (which is why the total mean value is slightly lower than 150, at 144 Wh/kg). However, polyanionic compound-based SIBs have other beneficial performance, such as long cycle life. The highest gravimetric energy density is CATL's Prussian blue analog-based Naxtra battery at 175 Wh/kg, and the lowest is Tiamat's and Tianneng's polyanionic compound-based SIBs at 95 Wh/kg (although Tiamat claims to have a generation 2 with higher energy density in pipeline).

Table 3. Gravimetric energy density statistics based on the data in Table 2.

Cathode material	Gravimetric energy density (Wh/kg)			
	Mean	Median	Min	Max
Layered metal oxides	149	153	110	165
Polyanionic compounds	128	126	95	170
Prussian blue analogs	155	160	130	175
All	*144*	*150*	*95*	*175*

Regarding applications, 84% of the companies report that the SIBs are intended for use in electric vehicles, and 77% report BESS as intended use. Specifically, 35% of the companies highlight small electric vehicles, such as two-wheelers and forklifts. Indeed, You (2025) describes how electric scooters are driving SIB commercialization in China. Consumer products are highlighted by 6% of the companies. This suggests that according to the SIB producing companies, electric vehicles is a relevant application for SIBs, in particular lighter electric vehicles. However, there are also some companies that have highlighted electric cars as potential applications. Considering the high gravimetric energy densities reported by some companies, such as CATL, which are in the same range as LFP batteries, this might not be impossible.

An important property of SIBs often referred to by companies is their ability to withstand low temperatures. For example, the company Altris has a collaboration with military companies to produce batteries that can withstand the sometimes-cold climate of the Nordics. This has been highlighted as a major advantage of SIBs in several sources. This benefit probably applies to both BESS and electric vehicles of different kinds.

4. Conclusions

According to our estimates, the global SIB production in 2025 was approximately 70 GWh, and can be expected to increase to about 250 GWh in 2030. This estimate is at the higher end of available estimates. About 13 different companies producing above 5 GWh are expected in 2030, which together will produce about 90% of the world's SIBs. Production will likely be dominated by the two major battery producers, CATL and BYD, accounting for approximately 50% of the market. Overall, Chinese companies dominate at about 66% of the number of current SIB-producing companies and 84% in terms of production volume in 2030. Second place is the United States with 14% and 9%, respectively. Europe and India have similarly low shares.

Regarding SIB technologies, layered metal oxides, polyanionic compounds, and Prussian blue analogs are all used by major producers and likely to be produced also in 2030. Layered metal oxides and polyanionic compounds are investigated by a higher number of companies, but Prussian blue analogs are considered by the biggest current and expected future SIB producer CATL. They are thus all considered to "be in the race". Regarding anode materials, the majority of companies (about 95%) use hard carbon.

The gravimetric energy densities reported are in the range of 95-175 Wh/kg, with a mean value at 144 and a median value at 150 Wh/kg. Both layered metal oxide- and Prussian blue analog-based SIBs have mean and median gravimetric energy densities at about 150 Wh/kg, while polyanionic-based SIBs are slightly lower at about 130 Wh/kg.

Both electric vehicles and BESS are highlighted as potential applications, particularly smaller electric vehicles like electric scooters. The ability to withstand cold temperatures is potentially an important property of SIBs.

In conclusion, the LIB technology will likely be accompanied by a "baby sibling" in the near future, the SIB. The share of SIBs in 2030 is estimated at approximately 5-10% of the rechargeable battery market.

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